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Tooth brushing frequency and risk of new carious lesions.

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Summary
(evidence level 2A) Review / Caries

Abstracted from

Kumar S, Tadakamadla J, Johnson NW. Effect of Toothbrushing Frequency on Incidence and Increment of Dental Caries: A Systematic Review and Meta-Analysis. J Dent Res. 2016 Oct;95(11):1230-6. doi: 10.1177/0022034516655315. Epub 2016 Jun 22. Review. PubMed PMID: 27334438.

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Question Does toothbrushing frequently reduce caries?

Data sources Medline, Embase, CINHAL, and the Cochrane databases.

Study selection Two reviewers selected studies and case-control, prospective cohort, retrospective cohort, and experimental trials evaluating the effect of toothbrushing frequency on the incidence or increment of new carious lesions were considered.

Data extraction and synthesis Two reviewers undertook data abstraction independently using pre-piloted forms. Study quality was assessed using a quality assessment tool for quantitative studies developed by the Effective Public Health Practice Project (EPHPP). Meta-analysis of caries outcomes was carried out using RefMan and meta-regressions undertaken to assess the influence of sample size, follow-up period, caries diagnosis level and study methodological quality.

Results 33 studies were included. 13 were considered to be methodologically strong, 14 moderate and 6 weak. 25 studies contributed to the quantitative analysis. Compared with frequent brushers, self-reported infrequent brushers demonstrated a higher incidence of carious lesions, OR=1.50 (95%CI: 1.34 -1.69). The odds of having carious lesions differed little when subgroup analysis was conducted to compare the incidence between ≥2 times/d vs <2 times/d, OR=1.45 (95%CI; 1.21 – 1.74). and ≥1 time/d vs <1 time/d brushers =OR 1.56; (95%CI; 1.37 – 1.78). Brushing <2 times /day significantly caused an increment of carious lesions compared with ≥2/day brushing, standardized mean difference [SMD] =0.34; (95%CI; 0.18 – 0.49). Overall, infrequent brushing was associated with an increment of carious lesions, SMD= 0.28; (95%CI; 0.13 – 0.44). Meta-analysis conducted with the type of dentition as subgroups, found the effect of infrequent brushing on incidence and increment of carious lesions was higher in deciduous, OR=1.75; (95%CI; 1.49 – 2.06) than permanent dentition OR=1.39; (95% CI: 1.29 -1.49). Meta-regression indicated that none of the included variables influenced the effect estimate.

Conclusions Individuals who state that they brush their teeth infrequently are at greater risk for the incidence or increment of new carious lesions than those brushing more frequently. The effect is more pronounced in the deciduous than in the permanent

dentition. A few studies indicate that this effect is independent of the presence of fluoride in toothpaste.

Commentary

Tooth brushing frequency and risk of new carious lesions

Common advice to patients from oral health care professionals worldwide includes recommendations for twice-daily tooth brushing, usually with adjuncts such as an appropriate concentration fluoride toothpaste.[1,2] The authors of this systematic review found that there is ambiguity in the evidence for a clear association between the effect of tooth brushing frequency *per se* and dental caries. A positive aspect of this review is that it conforms to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.[3] A helpful flowchart illustrates how the authors arrived at the included studies, together with reasons for their exclusion of articles.

The search strategy involved four key electronic databases which identified journal articles published between early 1980 and late 2015. A limitation is that only studies published in the English language were considered, however the authors applied no restrictions to the study population which meant that all ages (and therefore both dentitions) were included. For transparency, the authors published their search strategy, the articles included and excluded, their quality ratings of studies and a summary of relevant statistical analysis as online Appendices.

The review considered only longitudinal studies as the authors wished to determine whether tooth brushing frequency was predictive of new carious lesions. Each study's methodological quality was assessed independently by two reviewers using a recognised assessment tool.[4] The majority of the included studies were either 'moderate' or 'strong' in quality, however factors such as the characteristics of each study population, the method of diagnosis of caries and the length of follow-up differed. In the latter category, the follow-up periods ranged from 11 months to 15 years. After 4,305 records were identified (following the removal of duplicates), 33 studies were included whilst 25 studies contributed to the meta-analysis.

The 'exposure' in this systematic review was individuals' *reported* tooth brushing frequency. Consequently we do not know how respondents' self-reported brushing frequencies relate to their actual tooth brushing behaviour. As the authors of the review acknowledge, tooth brushing combines many other variables such as the duration of brushing, the design and quality of the brush, the brushing method and the toothpaste used (if any). Unfortunately, the potential influence of these individual effects could not be separated in the observational studies included in the review.

The authors identified two outcomes of interest: caries incidence (proportion of individuals developing new carious lesions) and caries increment (mean of new carious

lesions). The authors found that brushing frequency categories varied considerably between the studies which involved the authors having to perform subgroup analyses.

Most studies diagnosed carious lesions only when they were cavitated. This creates a potential for the underestimation of dental caries, whilst a few studies categorised non-cavitated lesions as 'carious' leading to possible overestimation of dental caries. However, the authors sensibly conducted a meta-regression analysis to determine the influence of potential confounding variables (including caries diagnosis level, follow-up period, sample size and methodological quality). None of these variables influenced the effect estimate.

Infrequent brushers demonstrated a higher incidence of carious lesions than frequent brushers (OR: 1.50; 95% CI: 1.34-1.69). This result differed little when subgroup analysis compared tooth brushing frequency (typically grouped as ≥1 Vs <1 times a day and ≥2 Vs <2 times a day). There was a higher incidence and increment of carious lesions in those reporting infrequent brushing in the deciduous dentition (OR: 1.75; 95% CI: 1.49-2.06) than the permanent dentition (OR 1.39; 95% CI: 1.29-1.49), possibly because, as the authors acknowledge, the deciduous (primary) dentition has greater susceptibility to dental caries.[5]

The authors found no evidence of publication bias amongst the included studies, but they acknowledge there are limitations with this study as a consequence of the lack of comprehensive data included within the primary studies. When interpreting the results from the meta-analysis, it was not possible to separate the contribution of fluoride in toothpaste because none of the studies provided the data needed. However, the authors do refer to a few studies that indicate that frequent brushers are at reduced risk for the incidence of carious lesions independent of the presence of fluoride in toothpaste.

Most of the studies contributing to this review were from high-income countries which suggests a need for greater input from studies conducted in lower-income countries. This may help to isolate the effectiveness of tooth brushing frequency on the development of carious lesions, especially if some of these countries may not use fluoridated dental products as routinely.

The results of this systematic review and meta-analysis may not particularly surprise oral health professionals. However, the more pronounced effect between infrequent brushing and the increment and incidence of new carious lesions in the deciduous dentition, highlights the role for evidence-based disease prevention and developing good oral hygiene behaviours at an early age.

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